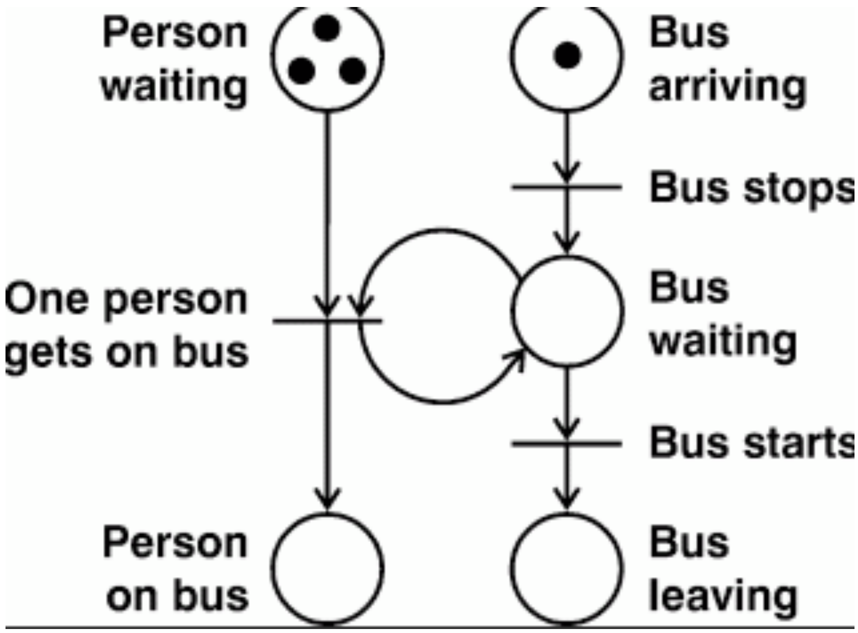
COSC 681 Final   Take Home   Name:_______________________________

Return to class 19 December 2016

1. Consider this Petri net (found on the web):



A. Is it possible for the bus to leave before all passengers board?

B. Will this Petri net model a passenger getting off the bus?

C. Is it possible for a person to leave this system without getting on a bus?

2. A. Create Petri net that models passengers waiting for and boarding two buses.

2. B. Create Petri net that models passengers waiting for, boarding, and disembarking from one bus.

3. Find equilibrium point(s) for this discrete model:

$$x_t = x_{t-1}\, y_{t-1}$$
$$y_t = x_{t-1}\, y_{t-1} - 2y_{t-1}$$

4. Consider this continuous model:

$dS/dt = -10^{-9}\ I(t)\ S(t)$

$dI/dt = 10^{-9}\ I(t)\ S(t) - 0.2\ I(t)$

$dR/dt = 0.2\ I(t)$

a. Are there equilibrium point(s)? If so, what are they?

b. What is the behavior as time grows large? (I.e., is there asymptotic behavior).

5. Hidden Markov Model. Consider the fair/loaded coin tossing model

transition probabilities $P(X_t \mid X_{t-1})$

		X_t fair	X_t loaded
X_{t-1}	fair	0.9	0.1
	loaded	0.1	0.9

observation model (emission probabilities) $P(Y|X)$

		Y H	Y T
X	fair	0.5	0.5
	loaded	0.9	0.1

Suppose you have observations $Y_1\ Y_2\ Y_3 = T\ T\ T$

Further, suppose that you have already computed $P(X_2 \mid Y_1\ Y_2 = T\ T)$ *as follows:*

$P(X_2 = fair \mid Y_1\ Y_2 = T\ T) = 0.6$
$P(X_2 = loaded \mid Y_1\ Y_2 = T\ T) = 0.4$

5. A. Predict the probability distribution for X3 with no additional observations (i.e. $P(X_3 \mid Y_1\ Y_2 = T\ T)$)

5.B. Given the prediction you computed in 5.A., what is the filtered probability distribution for X3 given observations $Y_1\ Y_2\ Y_3 = T\ T\ T$.
I.e., what is $P(X_3 \mid Y_1\ Y_2\ Y_3 = T\ T\ T)$?